AstroGrid and solar system science

S. Dalla[(1)], E.C. Auden[(2)], K. Benson[(2)] and N.A. Walton[(3)]

[(1)] School of Physics and Astronomy, University of Manchester, UK; [(2)] Mullard Space Science Lab, University College London, UK; [(3)] Institute of Astronomy, University of Cambridge, UK

1 Introduction

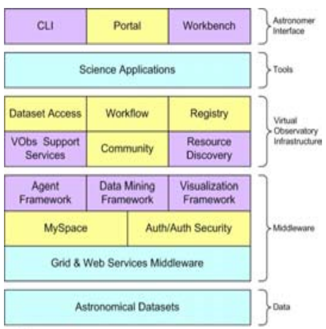
AstroGrid is a project funded by the Particle Physics and Astronomy Research Council (PPARC) to develop a Virtual Observatory for the UK.

AstroGrid is a founding member of the Astrophysical Virtual Observatory (AVO) (http://www.euro-vo.org) and is part of international VO efforts (http://www.ivoa.net) aimed at agreeing standards to ensure interoperability between datasets and VOs. A first AstroGrid prototype is to be released in January 2005.

PPARC has recently announced funding for AstroGrid 2, for the period 2005-2007. This includes developments aimed at the solar and STP communities.

2 Key Goals of AstroGrid

- Improving the quality, ease, speed, and cost effectiveness of online astronomy.
- Making comparison and integration of data from diverse sources seamless and transparent.
- Removing data analysis barriers to multi-wavelength studies.
- Enabling access and manipulation of large datasets. Data mining.



The system architecture for AstroGrid 2, noting how new components (in lilac) will build on the AstroGrid Release 1 system (in yellow). External components are in blue. Solar and STP specific capabilities will be produced in areas such as the data mining and visualisation areas.

3 Using AstroGrid

Some typical steps a user will go through:

Finding a resource. A user will want to view the databases and resources available within the system. A straightforward way to do this is to perform a registry search, for example specifying keywords identifying the dataset or resource required.

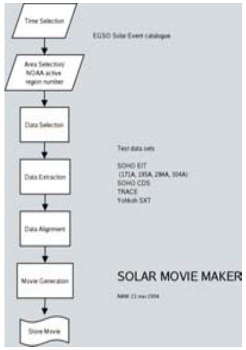
Building a query. Typical usage of AstroGrid will involve quering a specified database for all files meeting a given requirement. For example, within a solar physics dataset, a simple requirement could be 'find all datafiles for NOAA AR 9705'. To process such a query, use is made of tools developed by EGSO. AstroGrid uses SQL - Structured Query Language. The user saves the query into a file, which will later be sent to the database using a workflow.

Building a workflow. A user will need to identify all the tasks required for their scientific analysis and specify them in a workflow. In its simplest form, a workflow may involve a series of steps to be done one after the other, for example submit a query to a database and feed the results of the query into an application which operates on the data. More complex workflows may include, for example, conditional loops.

Submitting a workflow. After constructing a workflow, the user submits it to the system for remote execution. It is possible to monitor the progress of jobs and verify when a workflow has completed. Results of jobs are sent to a user's MySpace, where they can be viewed and downloaded. MySpace is an area of scratch space where a user stores files, typically queries sent to databases and results of queries and jobs. The physical location of this storage space is distributed over several machines.

4 Current solar developments

A review of the science requirements was carried out in the initial phase of the project and is described in the AstroGrid Phase-A Report. A set of science problems, also called the AstroGrid Ten Science Problems, were selected, aimed at demonstrating the capabilities of a VO within scientific areas of interest to the UK astrophysics community. The selected cases range from radio astronomy to solar and STP physics. One of the Ten AstroGrid Science Problems is the so-called Solar Coronal Waves case, as described at http://wiki.astrogrid.org/bin/view/VO/SolarCoronalWaves.



This illustrates the steps involved in creating the solar movie.

Within this science case, the objective is to build a movie of overlaid images from multiple solar datasets.

The user inputs the time interval and location of interest, for example by specifying the NOAA active region number. The capability of querying by active region number, or by event, relies on calling Solar Event Catalogue tools developed by EGSO. A query using these tools will return a list of files for the times and location required.

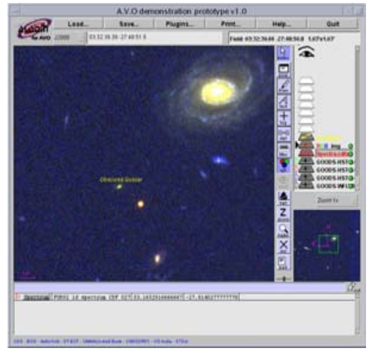
Images are calibrated and overlaid by means of the mapping software developed by D. Zarro, part of SolarSoft. A movie of the overlaid images is then created. To perform these steps, a user calls a movie-making tool into a workflow, and submits the workflow for remote execution.The result, delivered to the user's MySpace, is an mpeg movie of the images.

5 Conclusions and future work

The AstroGrid project is close to delivering a first release, that will demonstrate its science capabilities in a variety of astrophysics contexts, including solar and STP physics.

VOs have already produced new science, as shown by the discovery of previously unknown obscured high redshift quasars (Padovani et al 2004).

Future work within solar system science, as part of AstroGrid 2, will involve integrating several solar and STP datasets into the system, as well as analysis and visualisation tools to operate on them.



This illustrates the AVO/AstroGrid January 2004 demonstrator product, which enabled the discovery of previously unknown obscured high redshift quasars - see Padovani, Allen, Rosati and Walton, Astron. Astrophys., 424, 545-559 (2004). (Credit: AVO).

Datasets to be included will be, in the solar area: BiSON, Coronas-F, GOES SXI, SOHO CDS, TRACE, Yohkoh, STEREO, Solar-B, Solar Dynamics Observatory and Solar Orbiter.

In the STP area there will be: Cluster, CUTLASS/ SuperDARN, EISCAT/ESR, IRIS, and all datasets in the UKSSDC at RAL.

6 Further information and contact

The AstroGrid web site is at http://www.astrogrid.org

This website gives extensive documentation on the AstroGrid project, including the original proposals and project reports to PPARC. A description of the AstroGrid Ten Science Problems can be found at:

http://wiki.astrogrid.org/bin/view/Astrogrid/ScienceProblems

For further information on AstroGrid, please contact:

Nicholas Walton, AstroGrid Project Scientist, naw@ast.cam.ac.uk

Silvia Dalla, AstroGrid Deputy Project Scientist, s.dalla@manchester.ac.uk